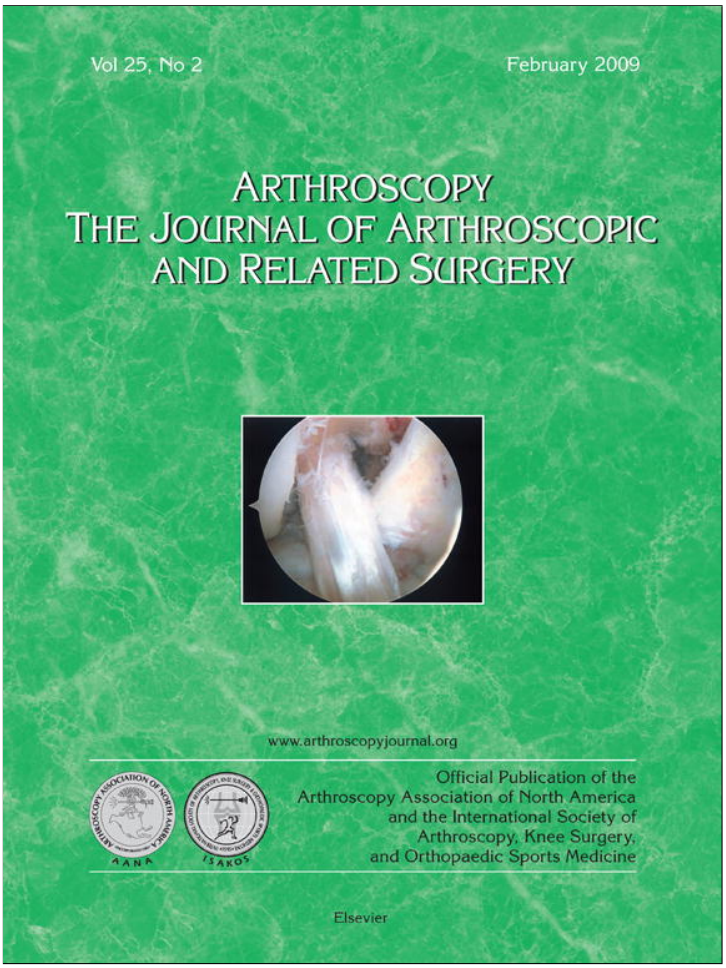

Editorial

Saving Our Cells: Advances in Tissue Engineering for Focal Cartilage Defects

Like many of our readers, your editors are clinicians. Yet, even though we are not basic scientists, we have called for papers on the topic of tissue engineering.[1] Why? Because like most of you, we are frequently faced with the challenge of treating patients with focal cartilage defects.

Although we are not convinced that autologous chondrocyte implantation (ACI, and also known as autologous chondrocyte transplantation or ACT) restores the unique architecture and collagen composition of normal hyaline cartilage, it is our expectation that in the future, this goal will be achieved. We also believe that membrane or matrix ACI (MACI), in which cells are implanted within or beneath a tissue-engineered collagen membrane (rather than covered with a periosteal flap), is not only advantageous as a less invasive arthroscopic surgical procedure, but a step in the direction of restoring hyaline cartilage. Recent research has focused on arthroscopic delivery and fixation techniques for MACI,[2,3] as well as techniques to prevent cells from becoming detached from the matrix during fluid flow conditions that improve visualization during arthroscopic implantation.[4] A prospective clinical study with 3-year follow-up evaluating MACI showed significant improvement in patient outcomes as measured using ICRS and modified Cincinnati scores. Of importance, the use of a type I/III collagen membrane (as opposed to host periosteum) to cover an autologous chondrocyte suspension resulted in complete avoidance of the complication of symptomatic graft hypertrophy.[5]

In the current issue, we highlight another advance in MACI techniques by Professor Matthias Steinwachs of Zurich. Having coauthored the clinical outcome study noted above,[5] Steinwachs now shares a new technique for cell-seeded collagen matrix-supported autologous chondrocyte transplantation (ACT-Cs).[6] It is clear that cell-based cartilage repair is of little value unless the fate of the transplanted chondrocytes is both localization within the defect and cell viability.[7] Thus, in common with Masri et al.,[4] Steinwachs' technique has a goal of SOC (Saving Our Cells).

Specifically, even with the advance of seeding and culturing chondrocytes using MACI, the membrane must be cut to the correct size and shape of the defect. Using ACT-Cs, the membrane may be cut to size before the application of expanded chondrocytes to the collagen during a 10-minute, intraoperative incubation period, thereby reducing the risk of viable cell loss and allowing direct application of high cell concentrations to the defect.[7] In other words, SOC.

However, MACI remains a "two-surgery technique," in which cells are harvested from a cartilage biopsy taken during the initial arthroscopic procedure, cultured in vitro, and then implanted. While ACT-Cs is a promising modification, our patients want a single operation. As we have previously asserted, future research must investigate not only manipulations of the matrix, but manipulation of cells using associated growth factors.[1]

The ultimate goal is a single-step, tissue-engineered solution to focal cartilage defects, and elimination of the morbidity of the donor defect.[1] While we continue to take the liberty of posing simple questions with complex answers,[1] our understanding of the literature suggests that this answer may lie in stem cells.[7,8]

In the interim, we clinicians and our patients owe a debt to basic scientists who are Saving Our Cells . . .

James H. Lubowitz, M.D.
Assistant Editor-in-Chief

Gary G. Poehling, M.D.
Editor-in-Chief

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